High-Pressure Preferred Orientation Neutron Diffractometer (HIPPO)

The High-Pressure Preferred Orientation (HIPPO) neutron diffractometer is the first third-generation neutron time-of-flight powder diffractometer to be constructed in the United States. It produces extremely high intensity by virtue of a short (9 m) initial flight path on a high-intensity water moderator and 1380 ^{3}He detector tubes covering 4.5 m^2 of detector area from 10° to 150° in scattering angles. HIPPO was designed and manufactured as a joint effort between LANSCE and the University of California with the goals of attaining world-class science and making neutron powder diffractometry an accessible and available tool to the national user community. Over two decades of momentum transfer are available (0.1–30 Å^{-1}) to support studies of amorphous solids; magnetic diffraction; small crystalline samples; and samples subjected to extreme environments such as temperature, pressure, or magnetic fields. The exceptionally high data rates of HIPPO also make it useful for time-resolved studies. In addition to the standard ancillary equipment (100-position sample/texture changer, closed-cycle He refrigerator, furnace), HIPPO has unique high-pressure cells capable of achieving pressures of 30 GPa at ambient and high (2000 K) temperature with samples up to 100 mm^3 in volume.

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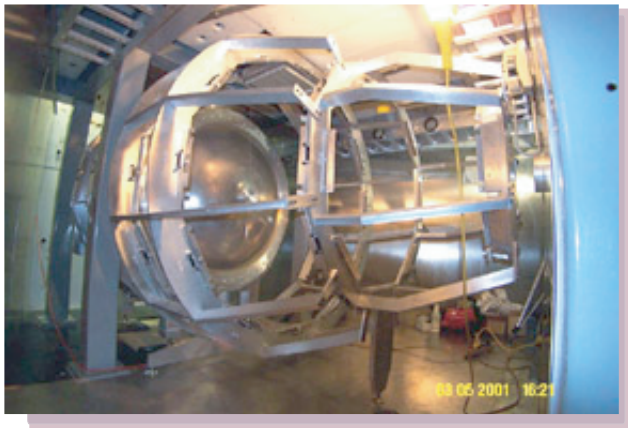
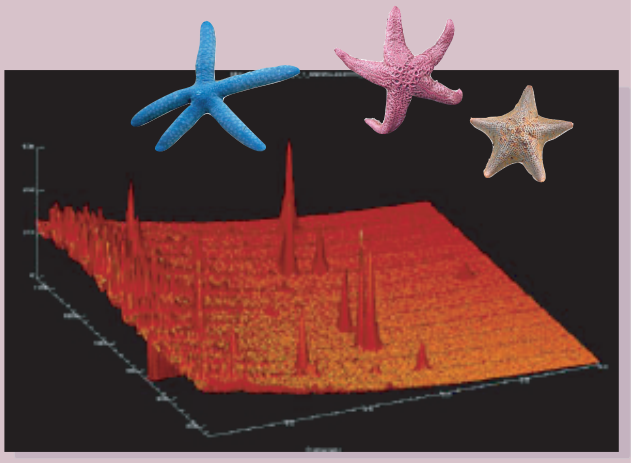


HIPPO frame without detectors.



The diffraction peaks show that starfish exo-skeletons are locally single crystals.

HIPPO Specifications

Performance	
Moderator	Chilled water, high intensity
Resolution and range at 150°	~ 0.4% and 0.12 Å < d < 4.8 Å (1.31 Å^{-1} < Q < 52.4 Å^{-1})
Resolution and range at 90°	~ 0.8% and 0.17 Å < d < 6.9 Å (0.91 Å^{-1} < Q < 37.0 Å^{-1})
Resolution and range at 40°	~ 1.5% and 0.35 Å < d < 13.9 Å (0.45 Å^{-1} < Q < 18.0 Å^{-1})
Resolution and range at 20°	~ 2.6% and 0.65 Å < d < 26.1 Å (0.24 Å^{-1} < Q < 9.7 Å^{-1})
Resolution and range at 10°	~ 5.0% and 1.20 Å < d < 47.5 Å (0.13 Å^{-1} < Q < 5.3 Å^{-1})
Primary Flight Path	
Moderator to sample	~ 9.0 m
Incident collimation (at sample)	5–20 mm diameter (round beam)
Secondary Flight Path	
Sample to 150° tube and detector area	~ 1.0 m and 0.93 m^2 resolution
Sample to 90° tube and detector area	~ 0.7 m and 1.06 m^2
Sample to 40° tube and detector area	~ 1.0 m and 1.11 m^2
Sample to 20° tube and detector area	~ 1.5 m and 0.99 m^2
Sample to 10° tube and detector area	~ 2.0 m and 0.50 m^2
Secondary Flight Path	
Maximum number of samples (non-texture)	100
Maximum number of samples (texture)	32
Texture tilt angle	-5°–25°
Texture rotation	0°–270°
Sample size (texture)	25 mm diameter
Sample size (non-texture)	9.5 and 6.3 mm diameter

HIPPO